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Standard Terminology Relating to Refractories¹

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1. Scope

1.1 This terminology covers terms particularly related to refractories and encompasses raw materials, manufacture, finished products, applications, and testing procedures.

1.2 When any of the definitions in this terminology are quoted or published out of context, editorially insert the limiting phrase “in refractories” after the dash following the term to properly limit the field of application of the term and definition.

2. Referenced Documents

2.1 ASTM Standards:

- C 24 Test Method for Pyrometric Cone Equivalent (PCE) of Fireclay and High-Alumina Refractory Materials²
- C 181 Test Method for Workability Index of Fireclay and High-Alumina Plastic Refractories²
- C 401 Classification of Alumina and Alumina-Silicate Castable Refractories²
- C 416 Classification of Silica Refractory Brick²
- C 456 Test Method for Hydration Resistance of Basic Bricks and Shapes²
- C 492 Test Method for Hydration of Granular Dead-Burned Refractory Dolomite²
- C 860 Practices for Determining and Measuring Consistency of Refractory Concretes²
- C 909 Practice for Dimensions of a Modular Series of Refractory Brick and Shapes²

3. Significance and Use

3.1 This terminology ensures that terms peculiar to refractories are adequately defined so that other standards in which such terms are used can be understood and interpreted properly.

3.2 This terminology is useful to those who are not conversant with the terms related to refractories. However, it is also a ready reference for those directly associated with refractories

to resolve differences and ensure commonality of usage, particularly in the preparation of ASTM standards.

3.3 Although this terminology is intended to promote uniformity in the usage of terms related to refractories, it can never be complete because new terms are constantly arising. The existence of this terminology does not preclude the use or misuse of any term in another context.

4. Terminology

4.1 Definitions:

abrasion of refractories, *n*—wearing away of refractory surfaces by the scouring action of moving solids.

acid refractories, *n*— see **refractories, acid**.

alumina-chromia brick, *n*—a refractory brick, which may be burned or unburned, manufactured predominantly of a mixture of a high-alumina raw material and chromic oxide (Cr_2O_3), with the alumina (Al_2O_3) content being 50 % or greater by weight and with chromic oxide (Cr_2O_3) predominating by weight among the other constituent oxides.

angle of repose, *n*—the acute angle measured from the horizontal to the slope of a cone-shaped pile of free-flowing material.

anthracite-coal-base carbon refractory, *n*—see **carbon refractory, anthracite-coal-base**.

basic refractories, *n*— see **refractories, basic**.

bat, *v*—to reject or discard a brick or shape.

binder, *n*—a substance added to a granular material to give it workability and green or dry strength.

bloating of refractories, *v*—substantial swelling produced by a heat treatment that causes the formation of a vesicular structure.

bond fireclay, *n*—see **fireclay, plastic or bond**.

burn, *v*—the heat treatment to which refractory materials are subjected in the firing process.

burning (firing) of refractories, *v*—the final heat treatment in a kiln to which refractory brick and shapes are subjected in the process of manufacture for the purpose of developing bond and other necessary physical and chemical properties.

calcine, calcines, *n*—refractory material, often fireclay, that has been heated to eliminate volatile constituents and to produce desired physical changes.

calcined refractory dolomite, *n*—see **dolomite, calcined refractory**.

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² *Annual Book of ASTM Standards*, Vol 15.01.

calcining of refractory materials, *v*—the heat treatment to which raw refractory materials are subjected, preparatory to further processing or use, for the purpose of eliminating volatile chemically combined constituents and producing volume changes.

carbon-ceramic refractory, *n*—a manufactured refractory comprised of carbon (including graphite) and one or more ceramic materials such as fireclay and silicon carbide.

carbon refractory, *n*—a manufactured refractory comprised substantially or entirely of carbon (including graphite).

carbon refractory, anthracite-coal base, *n*—a manufactured refractory comprised substantially of calcined anthracite coal.

carbon refractory, graphite-base, *n*—a manufactured refractory comprised substantially of graphite.

carbon refractory, metallurgical-coke-base, *n*—a manufactured refractory comprised substantially of metallurgical coke.

carbon refractory, petroleum-coke-base, *n*—a manufactured refractory comprised substantially of calcined petroleum coke.

castable, *n*—a combination of refractory grain and a suitable amount of bonding agent that, after the addition of a proper liquid, is generally poured into place to form a refractory shape or structure which becomes rigid because of chemical action (see Classification C 401).²

chemically bonded brick, *n*— see **unburned brick**.

chrome brick, *n*—a refractory brick, which may be burned or unburned, manufactured predominantly or entirely of refractory-grade chrome ore, and having a Cr₂O₃ content of 30 % or greater (see also chromic oxide brick).

chrome-magnesia brick, *n*—a refractory brick, which may be burned or unburned, manufactured predominantly of a mixture of refractory-grade chrome ore and refractory-grade magnesia in which the refractory-grade chrome ore predominates by weight; the refractory-grade magnesia may be either seawater magnesia, dead-burned magnesite, fused magnesia, or a combination of these materials.

chrome ore, refractory-grade, *n*—a refractory ore consisting essentially of chrome-bearing spinel with only minor amounts of accessory minerals and having physical and chemical properties suitable for making refractory products.

chromia-alumina brick, *n*—a refractory brick, which may be burned or unburned, manufactured predominantly of a mixture of chromic oxide (Cr₂O₃) and a high-alumina raw material, with the chromic oxide content being 50 % or greater by weight and with alumina (Al₂O₃) predominating by weight among the other constituent oxides.

chromic oxide brick—a refractory brick, which may be burned or unburned, manufactured predominantly of chromic oxide (Cr₂O₃) and having a Cr₂O₃ content of 90 % or greater (may also be called chromia brick).

concrete, refractory, *n*—a hardened castable.

consistency, *n*—the degree of mobility of a refractory castable as determined by Practices C 860.

corrosion of refractories, *n*—destruction of refractory surfaces by the chemical action of external agencies.

dead-burned, *adj*—the state of a basic refractory material

resulting from a heat treatment that yields a product resistant to atmospheric hydration or recombination with carbon dioxide.

dead-burned magnesite, *n*— see **magnesite, dead-burned**.

dead-burned refractory dolomite, *n*—see **dolomite, dead-burned refractory**.

diaspore clay, *n*—a rock consisting essentially of diaspore bonded by fireclay.

direct bonded basic brick, *n*—a fired refractory in which the grains are joined predominantly by a solid state diffusion mechanism.

DISCUSSION—The term “direct bond” was initially applied to fired magnesia-chrome refractories.

doloma-carbon refractory, *n*—a refractory brick manufactured predominantly from a mixture of refractory-grade doloma and 2 to 20 weight percent carbonaceous materials, with resin, tar, pitch or a combination of these materials as the bonding agent; the refractory-grade doloma may be either dead-burned dolomite, synthetic doloma, fused doloma or combinations of these materials, and the carbonaceous material may be either graphite, carbon black, or a combination of these materials.

doloma, fused, *n*—refractory-grade material consisting predominantly of lime and magnesia which has solidified from a fused or molten state.

doloma-magnesia refractory, *n*—a refractory, which may be burned or unburned, manufactured predominantly of a mixture of refractory-grade doloma and refractory-grade magnesia in which the refractory-grade doloma predominates by weight.

doloma refractory, *n*—a refractory manufactured predominantly of dead-burned dolomite, synthetic doloma, fused doloma or combinations of these materials.

doloma, refractory-grade, *n*—a dead-burned or fused refractory material consisting predominately of lime and magnesia; the three principal types are dolomite, dead-burned; doloma, synthetic; and doloma, fused.

doloma, synthetic, *n*—a refractory-grade doloma which has been derived from blending magnesia and lime or dolomite and dead-burning to form a dense, hydration-resistant material; and having a MgO content of 30 % to 80 % and maximum CaO content of 70 %.

dolomite, *n*—a carbonate rock consisting predominantly of magnesium carbonate (MgCO₃) and calcium carbonate (CaCO₃) in approximately an equal molecular ratio.

dolomite, dead-burned, *n*—a refractory grade doloma which is obtained by burning dolomite above 1450°C long enough to form a dense hydration-resistant material composed primarily of lime and magnesia.

erosion of refractories, *n*—wearing away of refractory surfaces by the washing action of moving liquids.

firebrick, *n*—any type of refractory brick specifically fireclay brick.

firebrick, insulating, *n*—a refractory brick characterized by low thermal conductivity and low heat capacity.

fireclay, *n*—an earthy or stony mineral aggregate that has as the essential constituent hydrous silicates of aluminum with

or without free silica, plastic when sufficiently pulverized and wetted, rigid when subsequently dried, and of suitable refractoriness for use in commercial refractory products.

fireclay, nodular, *n*—a rock containing aluminous or ferruginous nodules, or both, bonded by fireclay.

DISCUSSION—In some districts such clays are called “burley” or “burley flint” clay.

fireclay, plastic or bond, *n*—a fireclay of sufficient natural plasticity to bond nonplastic materials.

fireclay plastic refractory, *n*—a fireclay material tempered with water and suitable for ramming into place to form a monolithic furnace lining that will attain satisfactory physical properties when subjected to the heat of furnace operation.

flint fireclay, *n*—a hard or flint-like fireclay occurring as an unstratified massive rock, practically devoid of natural plasticity and showing a conchoidal fracture.

fused grain refractory, *n*—a refractory made predominantly from grain that has solidified from a fused or molten condition.

fused or fusion cast refractory, *n*—a solidified material made by melting refractory ingredients and pouring it into molds (see also **molten cast refractory**).

fused silica refractory, *n*—a product composed predominantly of fused, noncrystalline silica.

grain magnesite, *n*—see **magnesite, grain**.

graphite-base carbon refractory, *n*—see **carbon refractory, graphite-base**.

grog, *n*—a granular material produced from calcined or burned refractories, usually alumina-silica.

grog fireclay mortar, *n*—raw fireclay mixed with calcined fireclay, or with broken fireclay brick, or both, all ground to suitable fineness.

ground fireclay, *n*—fireclay or a mixture of fireclays that have been subjected to no treatment other than grinding or weathering, or both.

ground fireclay mortar, *n*—a refractory mortar consisting of finely ground raw fireclay.

ground refractory material, double-screened, *n*—a refractory material that contains its original gradation of particle sizes resulting from crushing, grinding, or both, and from which particles coarser and finer than two specified sizes have been removed by screening.

ground refractory material, single-screened, *n*—a refractory material that contains its original gradation of particle sizes resulting from crushing, grinding, or both, and from which particles coarser than a specified size have been removed by screening.

gunning, *v*—an application technique that uses a pneumatic means to transport a refractory material and place it onto a cold or hot surface.

gunning materials, refractory, *n*—mixtures of refractory aggregate and bond(s) specially prepared for gunning.

hydration resistance, *n*—the degree to which a refractory material resists chemical combination with water. This resistance is measured by either Test Method C 456 or Test Method C 492, whichever is applicable.²

insulating firebrick, *n*— see **firebrick, insulating**.

ladle brick, *n*—brick suitable for lining ladles used to contain molten metal.

magnesia brick, *n*—a refractory brick, which may be burned or unburned, manufactured predominantly or entirely of either seawater magnesia, dead-burned magnesite, fused magnesia, or combinations of these materials.

magnesia-carbon brick, *n*—a refractory brick manufactured predominantly of a mixture of refractory-grade magnesia and 5 to 30 weight percent carbonaceous material, with resin, tar, pitch, or a combination of these materials as the bonding agent; the refractory-grade magnesia may be either sea-water magnesia, dead-burned magnesite, fused magnesia, or a combination of these materials; and the carbonaceous material may be either flake or vein graphite, carbon black, or petroleum or metallurgical coke, or a combination of these materials.

magnesia-chrome brick, *n*—a refractory brick, which may be burned or unburned, manufactured predominantly of a mixture of refractory-grade magnesia and refractory-grade chrome ore in which the refractory-grade magnesia predominates by weight; the refractory-grade magnesia may be either seawater magnesia, dead-burned magnesite, fused magnesia, or a combination of these materials.

magnesia-doloma refractory, *n*—a refractory, which may be burned or unburned, manufactured predominantly of a mixture of refractory-grade magnesia and refractory-grade doloma in which the refractory-grade magnesia predominates by weight.

magnesia, fused, *n*—a refractory material consisting predominantly of crystalline magnesium oxide which has solidified from a fused or molten state.

magnesia, refractory, *n*—a dead-burned refractory material consisting predominantly of crystalline magnesium oxide.

magnesia, refractory-grade, *n*—a dead-burned or fused refractory material consisting predominantly of crystalline magnesium oxide; the three principal types are magnesia, sea water; magnesite, dead-burned; and magnesia, fused.

magnesia, sea water, *n*—a deadburned refractory-grade magnesia which has been derived from the treatment of sea water or other brines.

magnesia-spinel brick, *n*—a refractory brick whose predominant component is sintered or fused magnesia and whose lesser component is sintered, fused, or in situ formed magnesium aluminate spinel ($MgO \cdot Al_2O_3$).

magnesite, dead-burned, *n*—the granular product obtained by burning (firing) magnesite or other substances convertible to magnesia, upon heating above 1450°C long enough to form dense, weather-stable granules suitable for use as a refractory or in refractory products.

magnesite, grain, *n*—dead-burned magnesia in granular form of size suitable for refractory purposes.

magnesite, seawater, *n*—dead-burned magnesia made by a chemical process using seawater or other saline solutions.

metallurgical-coke-base carbon refractory, *n*—see **carbon refractory, metallurgical-coke-base**.